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**GRAPHICAL USER SURFACE AND METHOD FOR INDICATING A  
MALFUNCTION STATE OF AN ELECTROPHOTOGRAPHIC PRINTING  
OR COPYING SYSTEM**

- 5 The invention concerns a graphical user interface and a method for indication of a malfunction state of an electrophotographic printing or copying system. The invention also concerns a graphical user interface and a method for support in the correction of an error state of an electrophotographic printing or copying system and a system as well as a method for automatic generation of messages in an  
10 electrophotographic printer or copier.

Known electrophotographic printing or copying systems contain operating units with display and input units via which user interfaces are displayed. If an error state occurs, a text message is output (typically with an error code) that informs an  
15 operating personnel about the occurrence of the error. The error messages have preferably been displayed with the aid of an error list, what is known as the error journal or what is known as the error list [sic], in which messages of a plurality of occurred errors can be stored. An operating personnel could then determine the error cause and initiate steps for error remedy with the aid of manuals or via a  
20 telephone call to a service center of the printer or copier manufacturer. The call number of such a service center of the printer or copier manufacturer was specified in the manual of the printer or copier.

After the exchange of an expendable part and after the filling of consumable  
25 materials in a known printing or copying system, a new replacement expendable part or, respectively, new consumable material is re-ordered by filling out an order form that is then sent to the service center of the printer or copier manufacturer via fax or postal service.

- 30 A display device for a copying device is known from the document DE 32 47 871 A1, in which patterns or diagrams are printed out on a display panel, whereby

these patterns or diagrams are displayed through a color filter with a light source arranged behind them upon occurrence of a malfunction state. Given activation of the light source, individual elements can be displayed in the color "yellow" and other elements can be displayed in the color "red".

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Furthermore, from the document DE 101 46 335 A1 it is known to provide a multimedia user interface in a printer or copier. With the aid of the multimedia user interface, information about the functioning of the control of the printer or copier can be output to a user. The user interface also serves to support an  
10 operating personnel in the correction of an error state.

From the document FR 2 695 236 A1, a method is known for display of machine malfunctions of a polygraphic machine via which a fast discovery and remedy of machine malfunctions is possible with the help of image representations or a series  
15 of real images.

A system for determination of the exchange of a component in a printer is known from the document DE 101 46 335 A1, in which the printer sends a component exchange notice to a computer connected over a network. This computer can then,  
20 for example, send a fax with an order/information to a vendor.

A system with a plurality of printers or copiers is known from the document US 6 023 593, in which consumable materials can be ordered at a supplier with the aid of a central controller. With the help of a data communication device, the  
25 individual printers or copiers are queried in order to determine the need for consumable materials.

A monitoring and accounting system in a printer or copier is known from the document US 5 184 179. The monitoring and accounting ensues with the aid of  
30 number values that are recorded by a counter in the printer or copier.

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A display field of a copier in which error states are represented by showing the display element in the color yellow or red is known from the document US 4,586,034 A. However, a display element can only be shown in one color, whereby a concise error representation is difficult.

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An operating unit that contains display elements that contain a red lamp and a green lamp is known from the Patent Abstract of Japan for application 2000-046461. However, only one error state can be indicated in this operating unit.

- 10 From the document EP 0 699 966 A2 it is known to use a sequence of images as an aid for error correction, which images show the actions to be taken in series in order to arrive at the error location.

- 15 From the document US 2002/0079422 A1, a user interface is known with what a re known as selection buttons that contain schematic representations of selected structural units. By activating such a selection button, detailed information regarding the occurred error is shown in a display window.

- 20 It is the object of the invention to specify a graphical user interface, a system and a method for an electrophotographic printing or copying system with which a simple and fast error correction is possible and operator control actions for request of consumable materials and expendable parts as well as in malfunction notification are simplified.

- 25 This object is achieved according to a first aspect of the invention for a graphical user interface for display of a malfunction state of an electrophotographic printing or copying system with the features of the patent claim 1. Advantageous developments are specified in the dependent patent claims.

- 30 Errors and potential malfunctions or, respectively, warnings are signaled to an operating personnel via a color, variable display field via an inventive graphical

user interface according to patent claim 1, whereby malfunctions are in particular error states of the electrophotographic printer printing or copying system. An operating personnel thus immediately recognizes, i.e. at a glance, that the electrophotographic printing or copying system is in an undisturbed operating state, in an operating state with a malfunction or in an operating state with a potential malfunction, in particular in an alarm or warning state. The operating personnel can thereby furthermore quickly and specifically take measures for error correction and minimize the effect of a malfunction. The operating personnel can thus, for example, forward print jobs to other printing or copying systems.

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A second aspect of the invention concerns a method to indicate a malfunction state of an electrophotographic printing or copying system. With the help of such a method, an operating personnel can quickly and simply obtain information about the operating state of the electrophotographic printing or copying system, whereby the operating personnel can immediately take further steps for malfunction correction or to prevent a malfunction.

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A third aspect of the invention concerns a graphical user interface for support in the correction of an error state of an electrophotographic printing or copying system. Given the occurrence of an error state, i.e. given occurrence of a malfunction or a potential malfunction, a first graphic representation of at least one view of the printing or copying system is output with the aid of the graphical user interface. The region is thereby specified in which an occur has occurred. Furthermore, a second graphic representation can be output in which the error location is shown enlarged and/or more detailed in contrast with the first graphic representation. An operating personnel or a service technician is thereby given a precise aid in finding the error location. The error cause can thereby be quickly and specifically remedied. Furthermore, the at least two views that serve for indications for finding the error location and thus for fast remedy of the error state can be switched between.

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A fourth aspect of the invention concerns a method for support in the correction of an error state of an electrophotographic printing or copying system. Given an error state, at least one first graphical representation of at least one view of the printing or copying system in which the error state has occurred is output. At least one  
5 second graphical representation is subsequently output via which at least one enlarged or a more detailed representation of the error location occurs. An operating personnel can thereby be guided step-by-step to the error location. Long delays in the finding of the error cause are thus prevented. The operating  
10 personnel receives more detailed information for finding the error location with the aid of the views. The error location can thereby also be the location at which the error can be corrected.

A fifth aspect of the invention concerns a system for automatic generation of notices in the electrophotographic printer or copier. The system contains a data  
15 processing system that generates at least one text message upon occurrence of a pre-set event. For example, malfunction messages, re-orders of expendable parts and of consumable materials can thereby be generated without further operator

control actions of an operating personnel. Error causes such as the specification of wrong order numbers are prevented by the automatic generation of the message by the data processing system. Given occurred malfunctions, all data necessary to determine the malfunction cause can be contained in the automatically-created text notification.

A sixth aspect of the invention concerns a method for automatic generation of notifications in an electrophotographic printer or copier. After the occurrence of a preset event, a text message that contains specifications about the event is automatically generated with the aid of a data processing system of the printer or copier. The message is sent to a preset receiver. It is thereby achieved that messages are generated in a simple manner, whereby an operating personnel is unburdened and errors are prevented.

For better understanding of the present invention, reference is made in the following to the exemplary embodiments shown in the drawings, which are described using specific terminology. However, it is to be noted that the protective scope of the invention should not thereby be limited, since such variations and further modifications to the shown devices and the methods as well as such further applications of the invention as they are shown therein are viewed as typical present or future expert knowledge of a competent average man skilled in the art. Figures show exemplary embodiments of the invention, namely:

Figure 1      a graphical user interface for indication by an operating unit of an electrophotographic printing system according to a first exemplary embodiment of the invention;

Figure 2      a graphical user interface for indication by an operating unit of an electrophotographic printing system according to a second exemplary embodiment of the invention;

- Figure 3      the graphical user interface according to Figure 2 with a second representation of the printing system;
- 5      Figure 4      a graphical user interface similar to the user interfaces according to Figure 2;
- Figure 5      the user interface according to Figure 4 with a second representation of the printing system;
- 10      Figure 6      the graphical user interface according to Figures 4 and 5, whereby text message is output;
- Figure 7      the user interface according to Figures 4 through 6, whereby a message with error information about an occurred error state has
- 15      been automatically generated;
- Figure 8      the user interface according to Figures 4 through 7, whereby a message for re-ordering of an expendable part has been
- 20      automatically generated;
- Figure 9      an explanation of the display field of a malfunction indication and of a warning indication that are contained in the user interfaces according to Figures 1 through 8; and
- 25      Figure 10      an explanation of the symbols for control of the views to determine the error cause, which symbols are contained in the user interfaces according to Figures 1 through 8.

A first graphical user interface 10 according to a first exemplary embodiment of

30      the invention is shown in Figure 1. The graphical user interface 10 contains a first

section 12 with display fields and graphical function keys, what are known as buttons. The section 12 is also designated as a toolbar.

5 A first display field in the section 12 is designated with 14. This display field 14 is activated after the occurrence of a potential malfunction, for example when the toner reservoir or the paper reservoir of the printing system drops below a specific value or when consumable counters overrun or, respectively, underrun a specific number value. In the deactivated state, the display field 14 is shown in a grey tone that optically stands out with only a low contrast from the background of the  
10 section 12. The display field 14 is activated after the occurrence of an error, such that the display field 14 is essentially colored in a yellow color, whereby a relatively strong contrast with the background of the section 12 is created. The exclamation mark in the center of the display field is furthermore shown black.

15 A second display field 16 is activated after the occurrence of a malfunction. Similar to the display field 14, the display field 16 is shown in a grey tone in the deactivated state. The cross arranged in the center of the display field 16 is thereby shown in a white color. In a normal operating state in which no malfunction has occurred, the display field 16 thus does not prominently catch the eye of an  
20 operating personnel. After the occurrence of a malfunction, the display field 16 is significantly colored in a red color that is significantly high-contrast relative to the background of the section 12. The display field 16 is thereby optically strongly emphasized in the section 12. An operating personnel is thus very quickly and clearly informed about the operating state of the printing system. The display field  
25 14 also has a triangular shape and the display field 16 has a round shape for differentiation of the warning state and the malfunction state.

The section 12 furthermore contains a field 18 for text output in which the current operating state is output as text. Thus, after the occurrence of a malfunction state  
30 the display field 16 is activated and the text “stop” is output in the text output field. If only the display field 14 is activated, dependent on the cause of the potential



malfunction the text “warning” or “alarm” is output in the text output field 18. Both the display field 14 and the display field 16 is [sic] activated in the representation according to Figure 1. The malfunction notification has a higher priority than the message of a potential malfunction, such that after two warnings  
5 and a malfunction have occurred the text “stop” is output in the text output field 18.

A list with malfunction messages and warnings, what is known as the error list, is also output in a second section 20 of the graphical user interface 10 after the  
10 occurrence of an error. Two warnings and a malfunction are currently contained in the error list. For clear association with the message, the symbols of the display fields 14 and 16 are prefixed to the respective message, whereby the symbol of the display field 14 is prefixed to warnings and alarm messages and the symbol of the display field 16 is prefixed to malfunction messages.

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At least one detailed item of information about the error message, i.e. about the warning or the malfunction message, is output in the third section 22 via the selection of an error message in the second section 20 of the user interface 10. The third section 22 contains a separate toolbar 24 that contains graphical function keys  
20 and a text output field. The error message selected in the second section 20 is output in the text output field, whereby with the aid of the graphical function keys selection can be made between a text output mode with indications of the error cause and with data that are necessary to determine the error cause and at least one graphical representation of the printing system with an indication of the error  
25 cause.

A graphical representation of the back side of the printing system is shown in the third section 22 in Figure 1, since an operating personnel only has access to the error location from this side of the printing system. Furthermore, a flap 24 to be  
30 opened is optically emphasized in this graphical representation. This flap 24 must be opened to reach the error location. The operating personnel thereby receives a

precise instruction as to how she at least arrives at the error location. Further views that also contain information to remedy the error cause can be selected with the aid of the function keys of the toolbar 24. In further views of the printer, the third section 22 of the user interface 10 also contains text information, animated  
5 graphics and/or video sequences for remedy of the error cause.

The graphical user interface 10 furthermore contains a menu 26 in which various user interfaces can be selected. Setting values and parameters of the printing system can be changed and/or read out with the help of these user interfaces. The  
10 toolbar in the first section 12 contains further display fields and function keys. Thus in region 28 the toolbar contains graphical function keys for operation of the printing system that are also provided in hardware as buttons on the printing system. The graphical function keys in the region 28 optically coincide in shape, color and arrangement with the keys present on the printing system.

15 A printing channel of the printing system can be selected in the region 30 of the toolbar, whereby the activated channel is optically emphasized in the region 30. Existing print jobs can be aborted in the region 32 by an operating personnel, for example after a malfunction. Further display fields and function keys as well as a  
20 text output field with the display of the currently set user are contained in the regions 34 and 36 of the toolbar. The display fields 14 and 16 contained in the region 34 have already been described in detail further above. The graphical function keys of the toolbar 24 and the display fields 14 and 16 are specified in further detail in connection with Figures 9 and 10.

25 A graphical user interface 40 according to a second exemplary embodiment of the invention is shown in Figure 2. Like the user interface 10 according to Figure 1, the user interface 30 according to Figure 2 has a first section 42 that contains a toolbar. A second section 44 of the graphical user interface 40 contains an output  
30 of error messages and warnings, similar to the second section 20 of the graphical user interface 10 according to Figure 1. A third section 46 of the graphical user

interface 40 contains a toolbar 48, whereby a graphic representation of the printing system via which an operating personnel receives an indication of the error cause and/or the error location is given in the third section 46. Detail views of the printing system with the error location and/or views to reach the error location can  
5 be selected and called up with the aid of the graphical function keys of the toolbar 48.

The graphical user interface 40 furthermore contains a menu 50 with which can be called up the user interfaces that can be displayed in the regions 44 and 46. After  
10 the occurrence of an error state, i.e. a malfunction, and upon occurrence of a potential malfunction, for example a warning or an alarm state, instead of the control panel selected in the menu 50 the error list is displayed in the second section 44 and detail information regarding the malfunction is shown in the section 46.

15 The toolbar 42 contains a plurality of graphical function keys to control the printing system such as, for example, a stop button, a “ready” button and an “off” button, whereby these buttons respectively contain a display element that display [sic] the operating state of the respective button or, respectively, of the printing  
20 system. The toolbar 42 contains further graphical function keys for the control of print data and a selected print channel. The current status or, respectively, the current operating state of the printing system is output in a text output field 52, whereby the background color of the text output field 52 is changed dependent on the operating state of the printing system. The background color is thus red given  
25 the state “not ready” and green given the operating states “ready” or “in operation”. The toolbar 42 furthermore contains a display field 54 for display of potential malfunctions, i.e. warnings and alarm messages, and a display field for display of malfunction states. The activation of the display field 54 occurs essentially like the activation of the display field 14 according to Figure 1, and the  
30 activation of the display field 56 occurs essentially as described in connection with the display field 16 according to Figure 1.

The graphical user interface 40 is provided for an operation with the aid of a computer mouse or a comparable pointer device. The graphical user interface 40 is thus suitable for operation with the aid of computer mice, trackballs or for stylus  
5 input given touch-sensitive screens, what are known as touchscreens. The selection of individual function keys or menu entries thereby occurs in that the pointer device or, respectively, a pointer guided by the pointer device is positioned over the respective menu entry or the respective function key and is selected or, respectively, activated via a further operator control action, for example via what is  
10 known as a mouse click. The toolbar 42 contains a function key 57, whereby given an activation of this function key 57 the graphical user interface 40 is switched to a user interface 60 shown in Figures 4 and 5 that is in particular suitable for “finger operation” via a touch-sensitive screen.

15 The user interface 40 according to Figure 2 is shown in Figure 3, in which an error list with malfunction messages and warning is displayed in the display field 44 and a detail view of the printing unit is displayed in the display field 46, via which detail view an operating personnel receives an indication in order to arrive at the error location. The detail view of the printing system in the section 46 contains a  
20 display field 58 with a symbol that is similar to the symbol of the display field 56 for a malfunction message. Via the positioning of the display field 58 on the detail view in the section 46, the operating personnel furthermore receives an indication that the error search must be continued at this location in order to arrive at the error site, i.e. at the site at which a correction of the error can be implemented.

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In the present exemplary embodiment, a further flap of the printing system that has been marked by the display field 58 is to be opened. This display of the instruction for finding the error location concerns the error with the designation “DE ERROR PM038430”. If the graphical user interface 40 displays a different error in the  
30 error list in the section 44, a detail view of the printing system suitable for this error is shown in the section 46, whereby this representation then contains an

instruction for finding the error location. The other elements of the user interface 40 coincide with the elements of the user interface 40 shown in Figure 2. In other exemplary embodiments, instead of the error codes shown in Figure 2 and 3 a preset text stored in the operating unit is output (i.e. displayed) both in the error list in section 44 and in the display field of the toolbar 48.

A graphical user interface 60 similar to the user interface 40 according to Figure 2 is shown in Figure 4. The user interface 60 according to Figure 4 has been optimized for what is known as the finger operation of a touch-sensitive screen. In contrast to the user interface 40 according to Figure 2, the activation areas associated with the individual function keys and menu entries have been enlarged such that, given input via a finger contact, it is ensured that adjacent function keys or menu entries are absolutely not selected as well. A toolbar 62 contains the display fields and function keys that are contained [sic] the section 42 of the graphical user interface 40 according to Figure 2. The functions essentially coincide with the function keys and output fields shown there. The output of a section with an error list similar to the section 44 according to Figure 2 has been omitted in the graphical user interface 60 according to Figure 4 for space reasons. The space of the section 44 of the graphical user interface 2 has been used in the graphical user interface 60 according to Figure 4 in order to show the section 66 and the section 62 on a larger area. The section 66 contains a toolbar 68 with function keys via which a plurality of error messages containing error lists (not shown in this view) can be switched between in order to obtain detail information regarding these errors, which information is then shown in the section 66 as a graphical representation and/or as a text output.

Furthermore, the graphical user interface 60 contains a menu 70. In contrast to the menu 50 according to Figure 2, the menu 70 contains a reduced number of menu entries in which not as many menu branches of the present menu tree are shown. However, the individual menu entries of the menu 50 are associated with significantly larger activation areas, whereby a selection of a menu entry can occur

with the aid of a finger input via a touch-sensitive screen without accidentally selecting the adjacent menu entries or simultaneously selecting a plurality of menu entries.

5 The graphical user interface 60 according to Figure 4 is shown in Figure 5, whereby a detail view of the printing system is shown in section 66. The detail view significantly coincides with the detail view of the printing system shown in Figure 3. The error PM037470 was selected (with the aid of the function keys in the toolbar 68) from the error list not shown in the graphical user interface 60,  
10 whereby the detail view of the printing system shown in section 66 in particular receives an instruction for reaching the error site, in particular with the help of a display element 72.

With the aid of the function key 74, the user interface 40 can be switched to the  
15 representation according to Figure 3. With the help of the function key 56 in the toolbar, it can be switched again to the graphical user interface 60. As already mentioned in connection with Figures 1 through 3, the symbols of the toolbar 68 as well as the meaning of the representation of the display fields for errors and warnings are explained in further detail in connection with Figure [sic] 9 and 10.

20 The user interface 60 according to Figures 4 and 5 is shown in Figure 6, whereby what is known as a service ticket has been requested with the aid of a function key of the toolbar 68. A text output with error-relevant information occurs via the service ticket. The service ticket according to Figure 6 thus contains a customer  
25 number, a serial number of the printing system, an error description and an error code.

Furthermore, the service ticket contains information as to how to further proceed when the operating personnel cannot himself remedy the error. In the present case,  
30 the service ticket shown in section 66 contains the instruction that the operating personnel should call a service control center, whereby the telephone number of

the service control center is specified. In the present case, the operating personnel receives via this service ticket information as to where further information is to be obtained, namely from service technicians in the service control center. All information necessary for error description are displayed in the section 66 and are thus immediately available for the operating personnel upon making contact with the service control center. Given other errors, the service ticket can also contain concrete instructions for operator control actions for error correction.

The graphical user interface 60 with the service ticket (shown in Figure 6) for the error PM037470 is shown in Figure 7. In the user interface 60 according to Figure 7, it is pre-set that an e-mail notification is automatically generated upon invocation of a service ticket. In addition to the information that is contained in the service ticket, an input and output field 80 is also contained in the section 66. The input and output field 80 contains the text message "Error as e-mail to the service control center?" Via selection of this input and output field by an operating personnel, the generated e-mail notification is automatically sent to a preset e-mail address of the service control center.

The user interface 60 is shown in Figure 8 with a second service ticket. The second service ticket according to Figure 8 contains information for re-order of an exchanged consumable part and/or of consumable material. After the exchange of a consumable/expendable part and/or after the re-filling of the consumable material, a service ticket is automatically generated that is shown in window 66. Furthermore, an e-mail notification is generated that essentially contains the information of the displayed service ticket and that can be sent to a preset e-mail address. To sent this e-mail, an operating personnel must activate a button 82 that contains a text field with the text output "Would you like to re-order the consumable part? E-mail to the service control center". Via activation of the button 82, this e-mail message is automatically sent and the exchanged consumable part and [sic] or consumable material is re-ordered.

A table for explanation of the display fields 14 and 16 or, respectively, 54 and 56 is shown in Figure 9. As already explained in connection with Figures 1 through 8, the display field 14, 54 serves to signal a potential malfunction such as, for example, to signal an alarm state or a warning. If the printing system is located in a normal operating state, i.e. no alarm state or no warning exists, the display field 14, 54 (shown as a symbol which is also designated as an icon) is displayed in a deactivated state, i.e. in a greyscale representation. If the printing system is located in an operating state in which a potential malfunction exists, such as, for example, an alarm state or a warning, the display field is displayed in a blinking type of representation in which the display field is alternately shown essentially yellow and essentially grey. Upon activation of the graphical function key that is lodged in the display field, the error menu and warning menu (what are known as the error lists) are recalled and displayed.

The display fields 16, 56 contain a shape and design that is [sic] designated as what is known as an icon. The display field is displayed deactivated in a greyscale representation in a first, undisturbed state. In the event of an error, i.e. after the occurrence of a malfunction such as, for example, given a paper jam, the display field is displayed in a blinking representation in which the display field 16, 56 is alternately shown essentially red and essentially grey. The error list is recalled and displayed via activation of the graphical function key that is lodged in the display field 16, 56.

A table is shown in Figure 10 in which the symbols of the toolbars 24 and 68 are described. A graphical function key via which the action designated with the description in the column of the same row is executed is respectively stored [sic] with the symbols [sic]. An overall view of the printing system is shown in the window 22 or, respectively, 46, 66 via activation of the symbol shown in row 1. The current printing system view is enlarged via activation of the symbol in row 2. The current view of the printing system is shown shrunk with the aid of the symbol shown in row 3.



The view of the printing system can be shifted in the respective direction of the arrow shown by the symbol with the aid of the function keys stored with the symbols according to row 4. A service ticket can be displayed instead of the view  
5 of the printing system via the symbol in row 5. The return to the preceding view occurs via repeated activation of the function key stored with the symbol in row 5.

A detailed description of a selected error is output in the section 22, 46, 66 of the respective graphical user interface 20, 40, 60 via activation of the function key  
10 stored with the symbol in row 6. Via repeated activation of the same function key, the display of the detailed description is ended.

With the aid of the function keys associated with the symbols shown in row 7, the next or, respectively, a preceding error in the series in the error list can be changed  
15 to. A change of the representation type can occur with the aid of the function keys associated with the symbols shown in row 8. Thus a representation of the error list without printing system view, a representation of the error list with printing system view and a printing system view without error list can be changed between with  
the aid of the function keys.

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Although preferred exemplary embodiments are shown and described in detail in the drawings and the present specification, this should be viewed as purely exemplary and not as limiting the invention. It is noted that only the preferred exemplary embodiments are shown and described, and all variations and  
25 modifications that presently and in the future lie within the scope of protection of the invention should be protected.

## Reference list

	10, 40, 60	graphical user interface
	12, 42, 62	section with graphical function keys (toolbar)
5	14, 16, 54, 56, 57	graphical function keys
	24, 48, 68	toolbar
	20, 44	section with error list
	22, 46, 66	section for output of graphical representations and/or texts
	24	flap of a printing unit
10	26, 50, 70	menu
	28, 30, 32, 34, 36	regions of a toolbar
	52	output field
	80, 82	input and output field
	74	graphical function key
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